CLAIMS

What is claimed is:

1. A liquid crystal display (LCD) backlighting backlighting device, comprising:

a non-white light emitting diode;

a liquid crystal display; and

a phosphorized material located between the light emitting diode and the liquid crystal display, where the phosphorized material down converts light from the light emitting diode toward white light spectral radiance.

2. The LCD device of claim 1, wherein the non-white light emitting diode comprises a light emitting diode is selected from the group consisting of blue light emitting diodes and ultraviolet light emitting diodes.

3. The LCD device of claim 1, further comprising a second non-white light emitting diode that differs in color with the non-white light emitting diode comprises a plurality of different colored light emitting diodes.

4. The LCD device of claim 1, wherein the non-white light emitting diode is located along a perimeter of a flexible circuit board.

5. The LCD device of claim 4, wherein the non-white light emitting diode has a top reflective orientation with the light pipe.

6. The LCD device of claim 4, wherein the non-white light emitting diode has a side reflective orientation with the light pipe.

7. The LCD device of claim 1, further comprising a polarization scrambling material between the non-white light emitting diode and the light pipe, where the polarization scrambling material comprises apertures located adjacent to the non-white light emitting diode.

8. The LCD device of claim 1, wherein the phosphorized material comprises a phosphorized rubber.

9. The LCD device of claim 8, wherein the phosphorized material comprises a phosphorized silicone material.

10. The LCD device of claim 1, further comprising:

a light pipe; and

a reflective polarizer;

wherein light from the light pipe passes through the reflective polarizer before backlighting the liquid crystal display.

11. The LCD device of claim 10, wherein the phosphorized material comprises a phosphorized rubber.

12. The LCD device of claim 11, wherein the phosphorized material comprises a phosphorized silicone material.

13. The LCD device of claim 10 further comprising an enhanced specular reflector disposed near the non-white light emitting diode and the light pipe, wherein light from the non-white light emitting diode reflects from the enhanced specular reflector into the light pipe.

14. The LCD device of claim 10, further comprising a polarization scrambling material between the non-white light emitting diode and the light pipe, where the polarization scrambling material comprises apertures located adjacent to the non-white light emitting diode.

15. The LCD device of claim 14, further comprising a second polarization scrambling material located along the light pipe opposite the liquid crystal display.

16. The LCD device of claim 10 further comprising an enhanced diffuser reflector near the light pipe.

17. The LCD device of claim 10, further comprising a diffuser between the light pipe and the reflective polarizer.

18. The LCD device of claim 17, wherein the diffuser comprises a one-sided diffuser.

19. The LCD device of claim 17, further comprising a polarization scrambling material near the diffuser.

20. A liquid crystal display (LCD) device, comprising:

a non-white light emitting diode;

a light pipe;

a spectrum converting material between the non-white light emitting diode and the light pipe;

a light extracting surface located near a first side of the light pipe;

a diffuser located near a second side of the light pipe, where the first and second sides are opposite sides of the light pipe;

a reflective polarizer; and

a liquid crystal display;

wherein light from the non-white light emitting diode and converted by the spectrum converting material enters the light pipe passes through the diffuser, the reflective polarizer, then backlights the liquid crystal display.

21. The LCD device of claim 20, wherein the spectrum converting material comprises a phosphorized material.

22. The LCD device of claim 21, wherein the phosphorized material is disposed adjacent to the light extracting surface.

23. The device of claim 21, wherein the phosphorized material is disposed between the light pipe and reflective polarizer.

24. The LCD device of claim 20, wherein the light emitting diode comprises a top lighting light emitting diode.

25. The LCD device of claim 20, wherein the liquid crystal display comprises an active matrix liquid crystal display.

26. The LCD device of claim 20, wherein the diffuser comprises a phosphor coating.

27. The LCD device of claim 20, wherein the light pipe comprises a phosphor coating.

28. The LCD device of claim 20, wherein the light pipe comprises a phosphor impregnated light pipe.

29. The LCD device of claim 20, wherein the non-white light emitting diode comprises a blue light emitting diode.

30. The LCD device of claim 20, wherein the non-white light emitting diode comprises an ultraviolet light emitting diode.

31. The LCD device of claim 20, wherein the non-white light emitting diode is disposed near an edge of the light pipe.

32. The LCD device of claim 20, wherein the non-white light emitting diode is located along a perimeter of a circuit board.

33. The LCD device of claim 32, wherein the circuit board comprises a flexible circuit board.

34. The LCD device of claim 32, wherein the non-white light emitting diode has a top reflective orientation with an enhanced specular reflector near the end of the light pipe.

35. The LCD device of claim 32, wherein the non-white light emitting diode has a side reflective orientation with an enhanced reflector near the end of the light pipe.

36. The LCD device of claim 20, further comprising a thermally conductive material between the circuit board and a frame.

37. The LCD device of claim 20, further comprising an enhanced diffuser reflector near the light pipe.

38. The LCD device of claim 20, further comprising:

a second non-white light emitting diode that differs in color than the non-white emitting diode,

where the spectrum converting material comprises first and second regions, where the first region converts light from the light emitting

diode toward a first white light spectral radiance and the second region converts light from the second light emitting diode toward a second white light spectral radiance.

39. A liquid crystal display (LCD) device, comprising:

a light emitting diode that emits non-white light;

a spectrum converting material;

a diffuser;

a reflective polarizer; and

a liquid crystal display;

wherein light from the light emitting diode is converted by the spectrum converting material before the converted light passes through the diffuser, the reflective polarizer, before backlighting the liquid crystal display.

40. The LCD device of claim 39, wherein the liquid crystal display comprises an active matrix liquid crystal display.

41. The LCD device of claim 39, further comprising an enhanced diffuser reflector near the light pipe.

42. A liquid crystal display, comprising:

a non-white light emitting diode;

a light pipe with a phosphor coating that converts the spectrum of the non-white light emitting diodes and the light pipe;

a light extracting surface located near a first side of the light pipe;

an enhanced diffuser reflector located near an opposite side of the light pipe;

a diffuser located near a second side of the light pipe, where the first and second sides are opposite sides of the light pipe;

a reflective polarizer; and

a liquid crystal display,

wherein light from the light pipe passes through the diffuser, the reflective polarizer, then backlights the liquid crystal display.

43. A liquid crystal display (LCD) device, comprising:

a white light emitting diode;

a light pipe;

a light extracting surface located near a first side of the light pipe;

a diffuser located near a second side of the light pipe, where the first and second sides are opposite sides of the light pipe;

a reflective polarizer; and

a liquid crystal display;

wherein light from the white light emitting diode enters the light pipe and passes through the diffuser, the reflective polarizer, then backlights the liquid crystal display.

44. The LCD device of claim 43, wherein the white light emitting diode is located along a perimeter of a circuit board.

45. The LCD device of claim 44, wherein the circuit board comprises a flexible circuit board.

46. The LCD device of claim 44, further comprising a thermally conductive material between the circuit board and a frame.

47. The LCD device of claim 44, wherein the white light emitting diode has a top reflective orientation with the light pipe.

48. The LCD device of claim 44, wherein the white light emitting diode has a side reflective orientation with the light pipe.

49. The LCD device of claim 43, wherein the diffuser comprises a one-sided diffuser.

50. The LCD device of claim 43, further comprising a polarization scrambling material between the white light emitting diode and the light pipe.

51. The LCD device of claim 50, wherein the polarization scrambling material forms apertures near the white light emitting diode.

52. The LCD device of claim 50, further comprising a second polarization scrambling material located along the light pipe opposite the liquid crystal display.

53. The LCD device of claim 43, further comprising an enhanced diffuser reflector near the light pipe.

54. The LCD device of claim 43, further comprising an enhanced specular reflector disposed near the white light emitting diode and the light pipe, where light form the white light emitting diode reflects from the enhanced specular reflector into the light pipe.